

Remarks/Arguments

The Examiner is thanked for the careful review of this application. Applicant submits this Request for Reconsideration in response to the Office Action, dated March 6, 2003, issued in the Application. Claims 20-38 are pending. This Request for Reconsideration is being presented in the new format, as suggested by the new proposed Rules.

Rejections under 35 U.S.C. § 103(a)

It is respectfully submitted that claims 20-38 are patentable over U.S. Patent No. 6,066,569 to Tobben in view of U.S. Patent No. 5,700,740 to Chen et al. (Chen reference).

Tobben teaches using a dual damascene metallization process for manufacturing silicon integrated circuits including an organic intermetal dielectric. In Tobben, a layer of intermetal dielectric is provided over the top surface of a work piece. Then, a layer of hard mask material deposited over the intermetal dielectric layer is patterned to less than its full thickness, forming a stepped pattern without exposing the underlying intermetal dielectric. The work piece is then etched transferring the stepped pattern into the intermetal dielectric subsequent to which the pattern is filled with a desired metal. The lithography and resist stripping steps of the two-step hard mask patterning of Tobben are performed such that the organic (low K) dielectric layer is protected from oxygen plasma being used to strip the photoresist layer. Tobben indicates that oxygen plasma etching is the method normally used to do both lithography and photoresist stripping.

The next reference, Chen, teaches a method for preventing corrosion of aluminum or aluminum alloys interconnection wirings in semiconductor integrated circuits. Chen focuses on removing chlorine -containing residues attached to the sidewalls of the aluminum interconnect wirings patterned by ion etching using chlorine containing gas compounds.

Independent claims 20, 26, and 34 recite a method for removing photoresist material from a semiconductor substrate and a method for forming a semiconductor substrate. Among other features, for instance, independent claim 20 recites that the photoresist layer is removed from over the hard mask layer with dimethyl sulfoxide of a high pressure liquid chromatography (HPLC) grade while independent claims 26 and 34 recite implementing

dimethyl sulfoxide and liquid of HPLC, respectively. Each of the independent claims, 20, 26, and 34 specifically recites that photoresist is removed by dissolving the photoresist layer. Particularly, the photoresist layer is removed from over the hard mask layer without substantially damaging the low dielectric constant layer due to the high selectivity of the chemical used.

The Office acknowledges that Tobben does not disclose a method wherein the photoresist material is removed with dimethyl sulfoxide. The Office further confirms that Chen strips off the photoresist either by ashing with an oxygen containing plasma or by using a suitable solvent such as ACT-690, which is photoresist stripper consisting of a mixture of dimethyl-sulfoxide. Referring to the ACT-690, the Office asserts that Chen reads on applicant's limitation of using dimethyl sulfoxide of a high pressure liquid chromatography (HPLC) grade.

The Office then notes the following reasoning:

Unlike the claimed invention, neither Tobben nor Chen teach a method wherein a high selectivity of the dimethyl sulfoxide of HPLC grade toward low dielectric constant material of the low dielectric constant layer causes the dimethyl sulfoxide to chemically dissolve the photoresist layer from over the hard mask layer without substantially damaging the low dielectric constant layer. Chen et al does teach the dimethyl sulfoxide chemically dissolved the photoresist layer. Since the dimethyl sulfoxide layer chemically dissolves the photoresist layer and the same process steps are performed, it is inherent that the dimethyl sulfoxide has a high selectivity toward a low dielectric constant material, absent evidence to the contrary.

Applicant respectfully traverses the Office's contentions as the combination of Toben and Chen does not raise the prima facie case of obviousness against independent claims 20, 26, and 34. Specifically, there does not exist any suggestion or motivation in the cited prior art to modify Tobben in the manner proposed by the Examiner to arrive at the claimed invention.

As previously pointed out, the Office has failed to identify any objective rationale that would have motivated one skilled in the art to replace the plasma oxide etching taught in Tobin disclosed to be the prevalent method of removing photoresist layers by dissolving the photoresist using dimethyl sulfoxide of the HPLC grade (as defined in claim 20), dimethyl sulfoxide (as defined in claim 26), and immersing the substrate in an ultrasonic bath of HPLC

liquid (as defined in claim 34). Devoid of setting forth such objective reasoning, Tobben does not support the Office's assertions.

Furthermore, Applicant traverses Office's assertion that dimethyl sulfoxide inherently has a high selectivity toward a low dielectric constant material. Chen does not teach or disclose using of low constant dielectrics or challenges faced in removing photoresist material from over the low-K dielectrics. Rather, Chen focuses on removing chlorine-containing residues from sidewalls of interconnect lines in substrates wherein silicon dioxide or a composition layer of silicon nitride and silicon dioxide are used as dielectrics.

Chen also does not disclose or teach using dimethyl sulfoxide of high pressure liquid chromatography. Rather, Chen is silent as to the grade of the dimethyl sulfoxide. In fact, Chen discloses using dimethyl sulfoxide mixture. One of ordinary skill in the art would appreciate that dimethyl sulfoxide of HPLC grade has a different grade than a mixture that among several other components includes dimethyl sulfoxide.

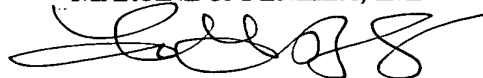
Next, as to high selectivity of dimethyl sulfoxide toward low-K dielectrics being inherent, Applicant submits that the Office has failed to show that dimethyl sulfoxide must *inevitably* have high selectivity toward low-K dielectric. To the contrary, Applicant submits that there is no reason for Chen to disclose that dimethyl sulfoxide has high selectivity toward dielectrics, not to mention low-K dielectrics, because Chen is focusing on removing chloride-containing residues from sidewalls. As such, Chen ignores the damages caused to the underlying low-K dielectric during photoresist removal. The mere fact that Chen suggests using dimethyl sulfoxide mixture to dissolve the photoresist does not inevitably mean that the underlying dielectric layer will not be damaged. As can be appreciated, the Office has ignored Chen's failure to mention such problems. Furthermore, Chen's failure to account for damages to the underlying dielectric, cannot be attributed to inherency of such conclusions. As set forth in M.P.E.P. § 2112, "[t]he fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic." As such, Applicant respectfully submits that the Office has failed to show that the mixture of dimethyl sulfoxide is highly selective toward dielectrics, much less toward low-k dielectrics. Thus, there is no reasonable basis for the assertion that Chen inherently discloses that the dimethyl sulfoxide is highly selective toward low-K dielectrics.

Accordingly, it is respectfully submitted that independent claims 20, 26, and 34 are patentable over the cited art of record, individually and collectively. Likewise, dependent claims 21-25, 27-33, and 35-38 are also submitted to be patentable over the cited art of record for at least the same reasons discussed above. Accordingly, Applicant respectfully requests that the § 103(a) rejections be withdrawn.

In view of the foregoing, Applicant respectfully submits that all of the pending claims 20-38 are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If the Examiner has any questions concerning the present Preliminary Amendment, the Examiner is kindly requested to contact the undersigned at (408) 749-6900, ext. 6913. If any additional fees are due in connection with filing this Amendment, the Commissioner is also authorized to charge Deposit Account No. 50-0805 (Order No. LAM2P266). A duplicate copy of the transmittal is enclosed for this purpose.

Respectfully submitted,

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